

# Health Impact Assessment: Proposed Cleanup Plan for the Lower Duwamish Waterway Superfund Site



Photo: Patrick Robinson, *West Seattle Herald*

Advance HIA Report  
May 2013



Photo: Paul Joseph Brown

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The views expressed are those of the authors and do not necessarily reflect the views of the Health Impact Project, The Pew Charitable Trusts, the Robert Wood Johnson Foundation, or the Rohm & Haas Company.

## Acknowledgments & Disclaimer

Photo: Derrick Coetzee





Photo: Courtesy of Duwamish River Cleanup Coalition “Duwamish Alive”

## Introduction

More than a century of industrial and urban wastes have contaminated water, sediments, beaches, fish, and shellfish in the lower Duwamish River with a mix of 41 toxic chemicals.

In 2001, the United States Environmental Protection Agency (EPA) placed 5.5 miles of the lower Duwamish River on the Superfund National Priorities List, requiring a Remedial Investigation and Feasibility Study. The Remedial Investigation, including a Human Health Risk Assessment of current cancer and other health risks from toxins in sediment, was finalized in 2010.<sup>1</sup> The Feasibility Study of cleanup alternatives was finalized in 2012. The Human Health Risk Assessment identified four chemicals of most concern for human health: PCBs, cPAHs, arsenic, and dioxins/furans.<sup>2</sup> The major pathways of concern for human health are resident fish or shellfish consumption and sediment contact. Each pathway poses excessive risks for cancer and “non-cancer” outcomes, such as cardiovascular, neurological, liver, immunological, and developmental problems. “Early Action” cleanups have begun or been completed at five extremely contaminated locations prior to long-term cleanup.

On February 28, 2013, EPA released its *Proposed Plan* (Plan) for overall site cleanup. The Plan is accompanied by two appendices, although these are not formally part of the Plan: *Environmental Justice Analysis* and *Source*

*Control Strategy*. EPA will accept public comment on the Plan until June 13, 2013, and expects to issue a final cleanup order in 2014.

Three partner organizations—University of Washington (UW) School of Public Health, Just Health Action, and the Duwamish River Cleanup Coalition/Technical Advisory Group (EPA’s Community Advisory Group for the Site)—have conducted a Health Impact Assessment (HIA) of EPA’s proposed cleanup Plan. This HIA was supported with a grant from the Health Impact Project, a collaboration of the Robert Wood Johnson Foundation and The Pew Charitable Trusts, plus funds from the UW Rohm & Haas Professorship in Public Health Sciences.

This is an *Advance HIA Report*, summarizing findings and recommendations of the HIA to date. The majority of the recommendations in this report are directed to the EPA. This report will be followed by a *Final HIA Report*, which will be submitted to EPA during the public comment period for the Plan and will contain recommendations to multiple decision makers. Both reports are supported by a collection of Technical Reports, which provide detailed information about the HIA methods, assessments, and recommendations.

All reports will be available on the UW Duwamish Superfund Cleanup HIA website:  
<http://deohs.washington.edu/>

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1. Human Health Risk Assessment = quantitative process used by EPA to estimate the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now or in the future.
  2. PCBs = polychlorinated biphenyls; cPAHs= carcinogenic polycyclic aromatic hydrocarbons



*hia-duwamish.*

## PROPOSED CLEANUP PLAN

EPA selected its proposed cleanup Plan (“5C+”) based on a Feasibility Study of eleven cleanup alternatives published in 2012. The Plan calls for:

- Capping of 24 acres of highly contaminated sediments in place.
- Removal of 84 acres of highly contaminated sediments that cannot be capped.
- Enhanced natural recovery of 48 acres of moderately contaminated sediments by adding a thin layer of clean material to “kick-start” the river’s natural sedimentation.
- Monitored natural recovery of 256 acres of relatively low-level contaminated sediments, with sampling to determine if concentrations of contaminants are declining over time.
- Institutional controls: administrative measures to prevent people and the environment from being exposed to remaining contamination, using legal tools such as easements or covenants, and informational tools, such as fishing advisories.

### WHAT IS HEALTH IMPACT ASSESSMENT?

Health Impact Assessment (HIA) is a systematic process used “to characterize the anticipated health effects, both adverse and beneficial, of societal decisions.... Characteristics of HIA include a broad definition of health; consideration of economic, social, or environmental health determinants; application to a broad set of policy sectors; involvement of affected stakeholders; explicit concerns about social justice; and a commitment to transparency.”<sup>3</sup>

For this HIA we use the World Health Organization definition of health, “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.”<sup>4</sup>

The Plan sets cleanup goals for the four chemicals of concern for human health. The goals were chosen to protect health or be equal to Puget Sound background concentrations, whichever is higher. However, the Human Health Risk Assessment and models of future concentrations in the Feasibility Study predict that the Plan’s goals will not be fully achieved. Resident fish and shellfish will probably still be unsafe for human consumption, even after the 17-year period of active cleanup and monitored recovery. In that event, the Plan calls for a study to determine if (a) additional cleanup action or (b) a “technical impracticability” waiver is warranted, requiring an additional EPA order.

### WHAT IS THE PURPOSE OF THIS HIA?

The purpose of this HIA is to examine potential unintended and under-considered health impacts—desirable or undesirable—of the *Proposed Plan* and related decisions. The HIA examines whether some people might experience disproportionate impacts: fewer new opportunities or greater health burdens.

We examined potential impacts for four distinct populations that have strong connections to the Duwamish River:

1. Local residents
2. Tribes
3. Non-tribal subsistence fishers
4. Workers in local industries

Figure 1 shows the major potential health impacts and causal pathways that we examined for these population groups, including these major types of population effects:

- Construction effects
- Restrictions on Tribal rights or practices
- Restrictions on non-tribal fisher practices
- Residential and industry gentrification
- Beneficial effects (and opportunities) for Tribes and for local communities and businesses

We examined these major types of intermediate health effects:

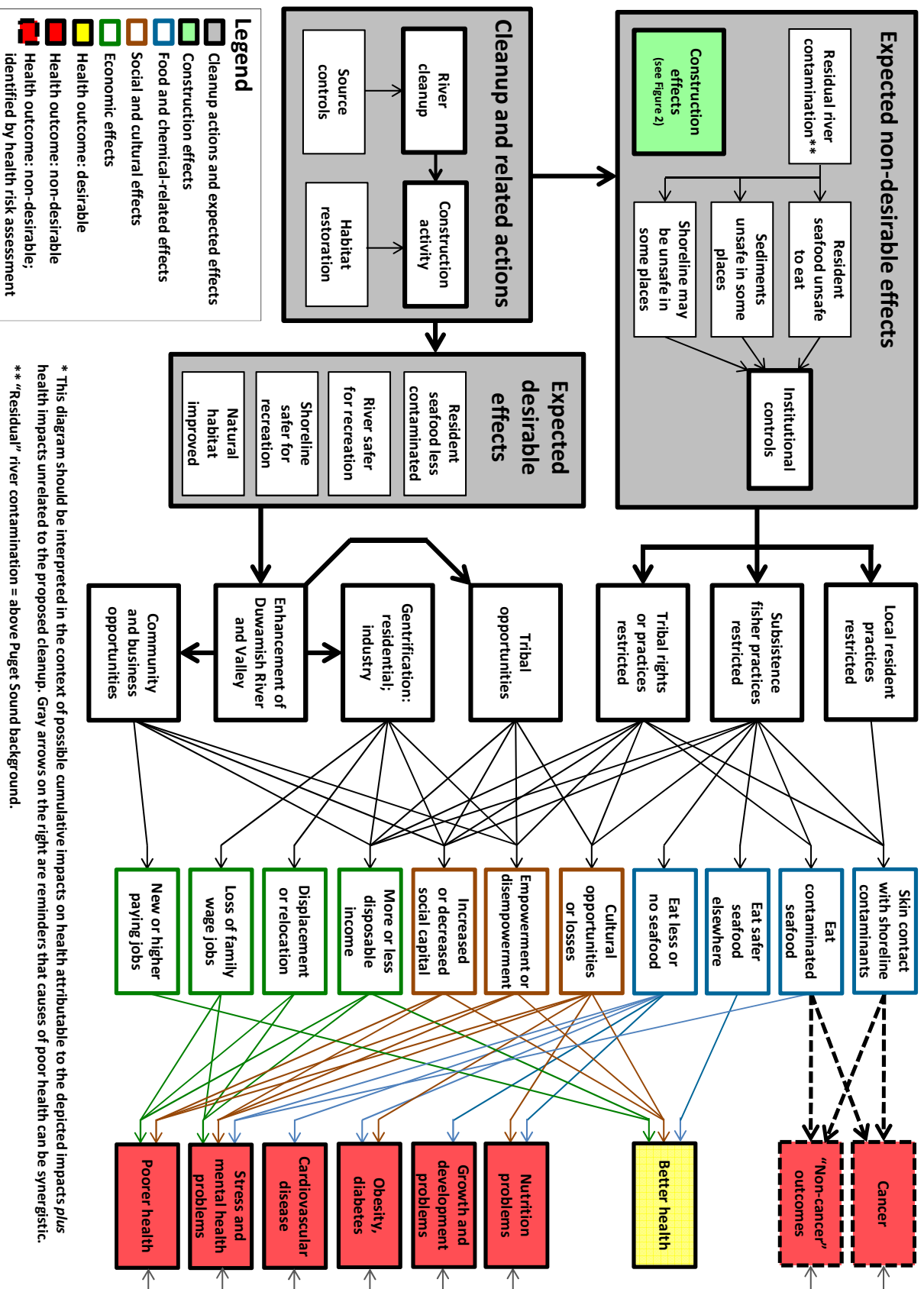
- Food and chemical-related effects
- Social and cultural effects
- Economic effects

Figure 1 illustrates the complexity and interactions between these effects and a variety of health outcomes, beyond those considered in the Human Health Risk Assessment.

3. Bhatia R. *Health Impact Assessment: A Guide for Practice*. Oakland, CA: Human Impact Partners, 2011

4. Preamble to the Constitution of the World Health Organization, entered into force in 1948.

**Figure 1: Potential health impacts of the proposed cleanup plan \***



## RESOURCES AND METHODS USED FOR THIS HIA

We relied on guidance from a variety of sources throughout this HIA, including:

- Stakeholder guidance—regular meetings and communication with our advisors:
  - Resident Advisory Committee (RAC), with representatives from South Park; Georgetown; Nickelsville, a homeless encampment; a nonprofit organization, Puget Sound Sage; and a former state legislator representing the South Park and Georgetown area, and formerly affiliated with the nonprofit, Homesight
  - Tribal Advisory Committee (TAC), with representatives from Suquamish and Duwamish Tribes. The Muckleshoot Tribe chose not to participate in the TAC
  - Liaison Committee (LC), with representatives from EPA, other agencies, and potentially responsible parties
  - Non-tribal fishing communities, via semi-structured interviews with individual community advisors and key informants
- Technical guidance from the Health Impact Project (Katherine Hirono, Aaron Wernham); Habitat Health Impact Consulting (Marla Orenstein); and Decision Research (Jamie Donatuto, Robin Gregory)

We used a wide assortment of information sources for the HIA, including:

- Peer-reviewed literature, published reports, and credible internet-based materials
- Data obtained from public databases or provided by individual organizations (e.g., Urban Indian Health Institute)
- Semi-structured interviews with selected community advisors and key informants
- Focus groups: one with members of the Duwamish Tribe; and multiple with non-tribal subsistence fishers

We conducted the HIA in six steps, which is standard in HIA practice:

- Screening
- Scoping
- Assessment
- Recommendations
- Reporting
- Evaluation

The methods used in each step will be detailed in a “Methods” Technical Report.

The UW Human Subjects Division approved our interview and focus group procedures. The Duwamish Tribal Council approved procedures and use of information for the Tribal focus group.

We developed our recommendations in collaboration with many stakeholders. Our community advisors and focus groups guided and informed selection, prioritization and wording of recommendations. Our Liaison Committee provided advice about wording, feasibility, and best decision-makers to receive individual recommendations.

## CURRENT STATUS OF THE HIA

At the time of this *Advance HIA Report*:

- Assessments are nearly complete for effects of the Plan on the local resident and Tribal populations. The RAC and TAC advisors and the LC continue to review these materials, and new data will be considered, as appropriate.
- Assessment of effects of the Plan on the non-tribal fisher population is nearly complete. Focus groups are continuing, and additional findings or recommendations will be in the *Final Report*.
- Assessment of effects on the worker population is still in progress and will be reported in the final report, but not in this *Advance Report*.

A Technical Report is available for each of the first three populations. The fourth, for local workers, is pending. Each technical report contains details and references that support the summary information provided in this *Advance Report*.

Photo: BJ Cummings, Duwamish River Cleanup Coalition/TAG







Photo: Paul Joseph Brown

## Effects of the proposed cleanup plan on local residents

Detailed information, including references, for this chapter is in the “Local Residents” Technical Report.

### COMMUNITY PROFILE

South Park and Georgetown are residential neighborhoods bordering the Duwamish River and Superfund site. Because of this proximity, residents are at risk for health effects related to the EPA Plan. A high percentage of residents are foreign-born and people of color, particularly in South Park. Average household income in both neighborhoods is much lower than the county average, and poverty rates are higher. In South Park, unemployment rates are 50% higher than the county average, and 78% of children at the local school qualify for free or reduced price lunch.

### CURRENT HEALTH STATUS

Health status is relatively poor in South Park and Georgetown, and for the 98108 ZIP code overall, which also includes Beacon Hill. Heart disease rates in South Park and Georgetown are 47% higher than the county average, while life expectancy is eight years shorter. In ZIP 98108, childhood asthma hospitalization rates are more than twice the county average, and rates of lung cancer, diabetes, and death from stroke are all higher. Environmental exposures, such as air pollution, industrial

releases, and contaminated sites, are among the highest in the city. However, environmental benefits, such as tree canopy, are less than elsewhere in Seattle.

### POTENTIAL HEALTH IMPACTS OF THE CLEANUP

#### **Construction: air and noise pollution**

*Direction of effect:* ADVERSE

*Likelihood:* Likely

*Magnitude:* Limited

*Distribution:* Disproportionate harm from noise for South Park residents; air impact not disproportionate<sup>5</sup>

*Health outcomes:* Diesel engine emissions contain high concentrations of particulate matter and other pollutants that, if inhaled, can cause or aggravate cardiovascular disease, asthma and other respiratory diseases, or cancer. Noise from construction equipment or vehicles can disturb attention or concentration ability, affect mental well-being, and cause or contribute to stress or other mental health problems. At night, noise or light pollution from construction activity could disrupt sleep patterns, with impacts on physical and mental well-being.

*Assessment:* Air pollution is already a significant problem in the Duwamish Valley, produced by vehicle emissions from highway traffic and port activity, and emissions from

5. Distribution refers to differences within the impacted community, and not disproportionate health impacts between the impacted community and the rest of Seattle, which exist and are substantial (see Duwamish Valley Cumulative Health Impacts Analysis, 2013).



industry point sources. Noise is also a significant existing issue, related to the same sources plus the King County International Airport (Boeing Field). Construction activities are likely to generate air pollution, although this will likely be a limited increment beyond existing pollution. The Feasibility Study estimates of cleanup air emissions were based on use of conventional fuels during construction, and are probably over-estimated. Updated fuel standards and EPA policies are designed to greatly reduce air pollutants, and the associated health impacts are expected to be limited.

### **Construction: rail and truck traffic**

*Direction of effect:* ADVERSE

*Likelihood:* Likely

*Magnitude:* Limited

*Distribution:* Disproportionate harm to Georgetown residents

*Health outcomes:* Increased truck traffic volume can increase risk of injury from pedestrian or vehicle collisions, or incidents triggered by road wear. Traffic congestion can disrupt community cohesion and quality of life. Increased traffic volume, vehicle idling, and rail freight transport could contribute to local air and noise pollution, as described above.

*Assessment:* If truck transport of dredged sediments between the river and rail facilities is required, then neighborhood impacts are likely, and could be moderate in magnitude. However, the reported plan to minimize the use of truck transport is expected to limit the magnitude of this impact. Anticipated cleanup-related rail traffic is estimated at 1–3 trainloads per month, a small addition to the 65–85 freight trains per day on local rail lines. These incremental impacts are expected to be of limited magnitude. Cleanup-related truck and rail traffic will primarily affect Georgetown residents.

### **Construction: job opportunities**

*Direction of effect:* BENEFICIAL

*Likelihood:* Likely

*Magnitude:* Limited to moderate

*Distribution:* Restorative equity effect; benefit to unemployed or lower-income residents

*Health outcomes:* Employment is one of the strongest favorable determinants of health. Employment, job training and skill development generate personal income and increase the likelihood of future employment and income

stability. These can contribute to personal and family adaptive capacity, improved healthful practices, better access to and ability to pay for health care, reduced risk for cardiovascular and other major diseases, and extended lifespan.

*Assessment:* Cleanups at other Superfund sites demonstrate the potential to generate cleanup-related jobs, including for local residents. In 2012, the Hudson River (New York) Superfund cleanup generated 350 jobs, including 210 filled by local residents. There is similar potential for local residents during the Duwamish River cleanup. While jobs will certainly be generated here, with beneficial impacts on health for those employed, whether those jobs will be given to local residents is currently uncertain.

### **Construction: dispersion of contaminants**

*Direction of effect:* ADVERSE

*Likelihood:* Possible

*Magnitude:* Limited

*Distribution:* Disproportionate harm to fish consumers and beach users

*Health outcomes:* As established in the Human Health Risk Assessment, chemical contaminants in Duwamish River sediments and beaches can cause cancer and other chronic health effects.

*Assessment:* Past dredging performance at other Duwamish River cleanup sites has been mixed, but the most recent and comparable dredging projects are promising in terms of minimizing construction-related dispersal of contaminants. The likelihood that contaminated material will escape outside the construction zone is low if environmental dredging technologies, best management practices, and skilled operators are employed. If contaminated material is not spread during dredging, then contamination of resident seafood will also be minimized.

### **Chemical contamination on beaches**

*Direction of effect:* ADVERSE

*Likelihood:* Possible

*Magnitude:* Limited

*Distribution:* Disproportionate harm to beach users in both communities

*Health outcomes:* All four chemicals of concern for human health (PCBs, arsenic, cPAHs, and dioxins/furans) can cause cancer and other health effects in humans, via skin contact, inhalation, or ingestion.

*Assessment:* Beaches throughout the lower Duwamish River have been evaluated. Several publicly accessible beach areas exceed state health standards for direct contact for one or more of the chemicals of concern. EPA predicts that its cleanup plan will approach but not meet direct contact goals for arsenic on some publicly accessible beaches. There are uncertainties in the predictive model, particularly the potential influence of source controls. The state is discussing whether to make the arsenic standard more protective.

### **Community opportunities: revitalization**

*We will report our assessment of these potential BENEFICIAL community impacts and opportunities in the Final HIA Report, with recommendations.*

Environmental improvements resulting from the Duwamish cleanup will likely increase the real and perceived aesthetics of the Duwamish River, and the esteem of areas surrounding the Superfund site. This may spur reinvestment in Georgetown and South Park. The flow of resources into these neighborhoods will likely contribute to the evolution of their character. Community revitalization can stimulate a number of beneficial phenomena.

### **Residential gentrification**

*Direction of effect:*

#### **BENEFICIAL**

*Likelihood:* Possible to likely  
*Magnitude:* Limited to substantial  
*Distribution:* Disproportionate benefit to higher-income residents

#### **ADVERSE**

*Likelihood:* Very likely  
*Magnitude:* Substantial  
*Distribution:* Disproportionate harm to lower-income residents

A process of gentrification often occurs alongside community revitalization, fundamentally changing neighborhoods. Gentrification generally involves physical improvements of housing stock, influx of higher-income residents, displacement of original residents, and overall change in neighborhood character that increases social polarity and decreases diversity.

*Health outcomes:* Changes in housing markets and residential conditions may have pronounced effects on the health of residents. Increased home values and equity will increase financial ability to maintain and improve housing and can improve overall adaptive capacity. Housing improvements may reduce harmful environmental exposures at home. Community improvements can facilitate active life practices, community interaction, and increased social capital. New local services and amenities can improve resources available to residents and expand employment opportunities. Increased local median income is associated with decreased local exposure to disease.

On the other hand, increased housing costs could displace households into cheaper, lower quality, or more crowded housing, with increased risk for injuries, rodent infestation, infectious diseases, and stress or mental illness. Reduced disposable income could constrain adaptive capacity, healthful practices, and ability to meet basic health needs, all of which increase risks for cardiovascular and other major chronic diseases. Relocation to other lower-cost areas could increase distance to employment options, and reduce access to healthy foods, transportation, quality schools, and supportive social networks. Real or perceived barriers between residents and decreased contact among neighbors may foster isolation, erosion of social capital, and disempowerment among existing residents. Low social and economic capital are independently associated with poor health outcomes and, when combined, contribute to an increased burden of poor health.

*Assessment:* Census-based demographic and economic data reveal a shift in the past decade toward increasing incomes in South Park and shrinking minority populations in Georgetown. Multiple indicators reveal that gentrification is already in progress and is likely to continue in both neighborhoods. It is likely that any cleanup-spurred reinvestment will contribute to this trend. Harmful impacts are most likely to affect lower-income residents, and benefits are most likely to affect higher-income residents. Strategic interventions to forestall gentrification and foster equitable revitalization could substantively benefit the health of current Georgetown and South Park residents.





Photos, left to right: BJ Cummings, Duwamish River Cleanup Coalition/TAG; Paul Joseph Brown; Linn Gould, Just Action Health

## RECOMMENDATIONS <sup>6</sup>

### *Cleanup construction and contamination*

1. ***Use proven and latest environmental dredging technology, experienced operators, and best management practices to minimize the spread of contaminated sediments during dredging.***

Two recent sediment dredging projects on the Duwamish River used GPS-directed environmental dredgers and experienced operators with little to no spread of dredged material offsite. A similar approach, backed by strict monitoring, can reduce the dispersal of toxins into the water and fish tissue during future sediment removal actions.

2. ***Negotiate transport routes and associated mitigation measures for cleanup-related truck and rail traffic with potentially affected residents, particularly in Georgetown.***

Final off-loading and transport routes for dredged sediments have not yet been determined but are expected to avoid using truck transport as much as possible. Most truck traffic, and all rail transport, will likely impact Georgetown residents but can be minimized by negotiating transport routes and related mitigation measures with affected residents.

3. ***Use modern clean engines or those with best available emission controls, Ultra Low Sulfur Fuels (ULSF), biofuel blends, compressed natural gas conversions, and no-idle and other “green remediation” techniques to minimize air emissions, plus effective noise and light minimization measures during active cleanup.***

Using modern engines or engines with best available emission control technology will help reduce emissions. In recent years, new federal rules have required commercial rail freight and most commercial trucks to upgrade to ULSF, dramatically reducing harmful diesel emissions. ULSF can also be used in cleanup construction equipment; and biodiesel blends, “no-idling,” and additional EPA green remediation policies may further reduce emissions. Noise minimization measures, similar to those recently used during the South Park Bridge construction project, will also help prevent health impacts.

4. ***Provide cleanup job training and placement assistance to local community members and affected residents.***

Training for cleanup-related jobs, job readiness skills, and job placement assistance programs can help ensure that affected residents benefit from cleanup employment and income opportunities. Examples of successful programs used elsewhere are EPA’s Superfund Jobs Training Initiative, and King County’s Brownfields Job Training Program.

5. ***Apply institutional controls, including educational signage and washing stations, at local beaches until health protective standards are met.***

Several contaminants currently pose low-level health risks to residents who frequently use local beaches. Measures should be taken to inform residents of potential risks and provide wash facilities for hands, feet, shoes, and pets after visiting Duwamish River beaches. These measures should be retained until it is confirmed that health-protective standards have been met.

6. These recommendations are directed specifically to EPA.

## RECOMMENDATIONS<sup>7</sup>

### ***Residential gentrification***

We will report our recommendations related to beneficial community revitalization and opportunities in the *Final HIA Report*.

**1. *Ensure equity in all policies, programs, and tools regarding environment and community development, in accordance with Seattle's Race and Social Justice Initiative and King County's Equity and Social Justice Ordinance.***

Consistent with the Seattle initiative and King County ordinance, all policies, programs, and tools should be culturally appropriate and should serve residents regardless of barriers presented by age, language, race, ethnicity, and citizenship status.

**2. *Coordinate management of future reinvestment and urban development by formalizing a coalition of agencies and community organizations to monitor and guide new development.***

A broad palette of institutional and organizational responses must be simultaneously integrated to promote neighborhood revitalization while forestalling adverse effects of gentrification. The EPA endorsed such a coordinated approach in a recent publication, *Creating Equitable, Healthy, and Sustainable Communities*. Other precedents for such proactive and comprehensive response include EPA's Urban Waters efforts, Green Zones initiatives in California, and the Let Us Build Cully Park project in Portland, Oregon.

**3. *Preserve affordability and produce affordable housing.***

If cleanup-spurred reinvestment results in improved housing stock and substantially increased rents in Georgetown and South Park, then ensuring the continued availability of affordable housing may help existing residents remain in the improved neighborhoods. Possible options include:

- Promote local development of affordable housing via land use code incentives, tax incentives, and public funding
- Facilitate tenant assistance by Seattle Housing Authority and community organizations

**4. *Promote and protect home ownership.***

If reinvestment results in substantially increased home values in Georgetown and South Park, then higher costs of ownership may prevent some prospective owners from buying homes. Financial difficulties may increase for both existing and new homeowners due to more precarious mortgages and increased tax liability. Possible options include:

- Expand home ownership by low-income families by promoting use of down-payment assistance, Homestead Community Land Trust, and other programs
- Address increased tax liability from rising home values via counseling and existing and new tax deferral, exemption, and relief programs
- Preserve home ownership through the Seattle Foreclosure Prevention Program

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7. These recommendations are directed toward City of Seattle and King County agencies.

Photo: Paul Joseph Brown







Photo: BJ Cummings, Duwamish River Cleanup Coalition/TAG

## Effects of the proposed cleanup plan on Tribes

Detailed information, including references, for this chapter is in the “Tribes” Technical Report.

### COMMUNITY PROFILE

Three Native American Tribes—the Duwamish, Muckleshoot, and Suquamish—are potentially affected by the Duwamish River cleanup.

The **Duwamish** Tribe’s ancestral lands are throughout Elliott Bay and the Duwamish River watershed. In 1851, the Duwamish people occupied 17 villages and 90 longhouses. The Tribe currently has nearly 600 enrolled members. The Tribe’s current Longhouse is on the Duwamish River, at the site of the Tribe’s historic winter fishing village, a National Historic Site. Chief Seattle was the first signer of the 1855 Treaty of Point Elliott, but city fathers fought a proposed Duwamish reservation. As a result the Duwamish Tribe currently has neither the federal recognition nor treaty fishing rights granted to other Tribes.

The **Muckleshoot** Tribe is a federally recognized Tribe, composed of descendants of the Duwamish and Upper Puyallup people. The Muckleshoot Reservation, established in 1857, lies along the White River in Auburn, WA. The Tribe currently has about 1,660 enrolled members. The Tribe has usual and accustomed fishing places, guaranteed by the Treaty of Point Elliott and upheld by the 1974 Boldt Decision. The Tribe conducts seasonal, commercial, ceremonial, and subsistence netfishing operations in the Duwamish River.

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*“Good air, water, food resources, self-sufficiency, involvement anywhere you can help.”*

The **Suquamish** Tribe is also a federally recognized Tribe. The Tribe traditionally lived along the Kitsap Peninsula, including Bainbridge and Blake Islands, across Puget Sound from present Seattle. The Tribe has about 950 enrolled members, half of whom live on the Port Madison Reservation. The Tribe has usual and accustomed fishing places, guaranteed by the Treaty of Point Elliott and the Boldt Decision. The Suquamish Tribe actively manages seafood resources just north (downstream) of the Duwamish Superfund site.

### CURRENT HEALTH STATUS

There are no publicly available health data that are specific to the Duwamish, Muckleshoot, or Suquamish Tribes. Therefore, we present findings for the American Indian and Alaska Native (AI/AN) population for King County and Washington State.

The AI/AN population shows significantly poorer health or socioeconomic status than the general population for

nearly 80% of the examined parameters. AI/ANs are:

- 2.6 times as likely to be in poverty
- 2.8 times less likely to have a college education
- 1.9 times as likely to be unemployed

AI/ANs in King County are:

- 1.9 times as likely to smoke
- 2.1 times more likely to have diabetes
- 1.7 times more likely to be obese

All three of these factors are associated with heart disease, which is 2.3 times as common in the AI/AN population, and is the leading cause of death in the U.S. for both Natives and the general population. There are also significant disparities in infant mortality rates, mental distress (stress, depression, and problems with emotions), cirrhosis deaths, and asthma.

## TRIBAL CONCEPT OF HEALTH

The Native American concept of health traditionally embodies a holistic perspective. One Tribal Advisory Committee member described individual health as “being at one with the universe, being in a state of non-conflict.” The well-being of the community is also important, encompassing collaboration, social cohesion, and empowerment. Additionally, health incorporates well-being of the environment, as described by a Duwamish Tribe member: “Good air, water, food resources, self-sufficiency, involvement anywhere you can help.”

The health and well-being of Native peoples are potentially affected in many ways by chemically contaminated sites. In addition to biophysical effects identified in the Human Health Risk Assessment, there can be a constellation of mental, emotional, and spiritual effects related to temporary and permanent changes in the land, ecosystems, and their interactions with culture and community.

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*“It’s our spiritual food so it feeds  
our soul; so it might poison our  
body, but then we’d rather nourish  
our soul.”*

Even when areas are remediated and made substantially cleaner, residual contamination is still likely to disproportionately affect Tribes.

## POTENTIAL HEALTH IMPACTS OF THE CLEANUP

The proposed cleanup will reduce sediment contamination levels and will therefore decrease seafood tissue concentrations over time. However, residual contamination above Puget Sound background levels, plus restrictions on river usage, could affect health in ways beyond those described in the conventional EPA Human Health Risk Assessment (Figure 1).

*Note: The chapters for the Local Resident and Subsistence Fishing populations use separate “health outcomes” and “assessment” subsections to summarize potential health impacts. This chapter, however, summarizes potential impacts using an integrated format that was approved by the HIA Tribal advisors and better reflects Tribal concepts of health.*

### Residual contamination

The conventional EPA Human Health Risk Assessment has shown that the Tribes are disproportionately impacted by the Duwamish River Superfund Site’s baseline contamination relative to the general population. In addition, residual risks after cleanup will continue to be substantial, and are predicted to exceed Puget Sound background. Tribal health outcomes are likely to be worse than predicted by the risk assessment because:

- The risk assessment approach only accounts for cancer and “non-cancer” biomedical disease outcomes and does not incorporate fundamental aspects of health and well-being such as the importance of accessibility to local natural resources, maintenance of cultural traditions, and significance of self-determination that are affected by residual contamination.
- Any river-related risks are compounded by existing Tribal health disparities and cumulative risks from both chemical and non-chemical stressors such as poverty, stress, food security, and concerns about self-determination, which were not considered in the EPA risk assessment.

Furthermore, although the cleanup will create a cleaner environment for all, disproportionality and inequity between the general population and the Tribes may actually increase. Resident seafood will be relatively safe to eat at the general population seafood consumption



rate of one meal per month, but not at the Tribes' seafood consumption rates (see Technical Report for details).

### ***Institutional controls***

Institutional controls, such as fish advisories due to residual contamination, restrict the amount of seafood that can be safely harvested by the Tribes. This is likely to affect Tribal population health in three ways:

- Restrictions violate Tribal fishing rights, which will lead to substantial disempowerment, an established determinant of health.
- Restrictions can affect food security and may prompt Tribal members to switch to alternative food sources that are not as healthy. This may cause other health problems including but not limited to obesity, diabetes, heart disease, and cancer.
- Restrictions may affect physical health since Tribal members may harvest fish in spite of biomedical warnings in order to protect aspects of their cultural

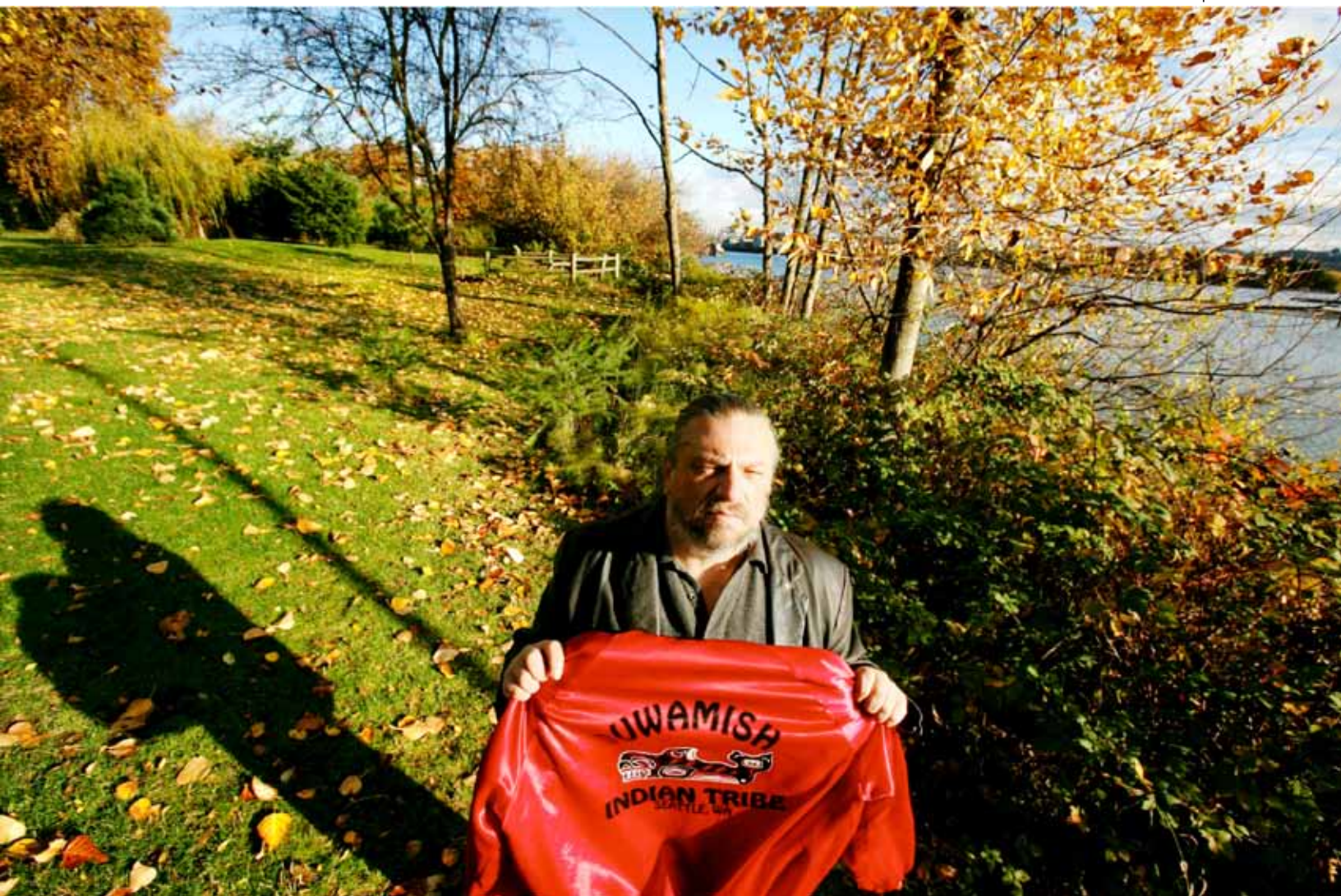
and spiritual health. As expressed by a Swinomish elder, "It's our spiritual food so it feeds our soul; so it might poison our body, but then we'd rather nourish our soul."

The decision to impose institutional controls, such as seafood advisories until recovery is complete, or possibly in perpetuity, will disproportionately affect the Tribes relative to the general population.

### ***Habitat renewal***

It is highly likely that more extensive and healthier habitat will improve Tribal health, because the overall environment and species of cultural importance to the Tribe will be enhanced. The Duwamish Tribe focus group reported that the Tribe will have more ceremonies on the river if there is more habitat, resulting in feelings of pride, ownership, and empowerment, all important determinants of health.

Photo: Paul Joseph Brown





## RECOMMENDATIONS<sup>8</sup>

### 1. *Collaborate with Tribes to more fully address their health concerns about the river cleanup.*

Remedial Action Objective 1 is to reduce to protective levels the human health risks associated with consumption of contaminated Lower Duwamish Waterway resident fish and shellfish by adults and children with the highest potential exposure. Despite the Human Health Risk Assessment's inadequacy in accounting for cumulative risks that may affect the Tribes, it still shows that residual contamination will negatively affect the Tribes' health. One approach to account for indigenous health concerns beyond a conventional risk assessment is to utilize the Indigenous Health Indicators method established by Donatuto and colleagues (Table 2, "Tribes" Technical Report). Indigenous health indicators may differ between Tribes and must be developed separately. A formal partnership with each affected Tribe is necessary in order to pursue this approach. Although the TAC already considers current cleanup plans inadequate because of residual risks above Puget Sound background levels, a partnership like this could provide evidence to determine whether the Plan should be more protective for Tribal health.

### 2. *Restore Tribes' traditional resource use in accordance with Treaty Rights: Institutional controls need to be temporary, not permanent.*

A long-term goal of the Tribes is to fully express their Treaty rights as expressed in the 1855 Treaty of Point Elliott, which firmly established the right to harvest fish at usual and accustomed grounds and stations. As long as institutional controls are in effect, these treaty rights cannot be fully expressed. This may result in health effects, including disempowerment, cynicism, and decreased access to harvest. The definition of temporary institutional controls needs to be defined and negotiated with the Tribes.

### 3. *Establish a "Revitalization Fund" to enhance Tribal empowerment and health, until Institutional Controls are removed.*

The Tribal populations suffer significant disparities in health relative to the general population, before even considering ramifications of the *Proposed Plan*. As described, institutional controls are disempowering because they limit established fishing treaty rights granted to the Tribes.

We recommend that the Responsible Parties direct resources to the Tribal communities to redress some of the inequities that will be compounded by institutional controls. A Tribal "Revitalization Fund" for each affected Tribe should be established and funded as long as institutional controls are in effect, to help address existing health inequities compounded by the compromised status of the river. Revitalization funds could improve community health through established determinants of health, including empowerment and ownership of the process. While each affected Tribe should control its own fund and select its own appropriate actions, one example from the TAC is using funds to build a new hatchery to enhance salmon stocks. Based on historical and ongoing cumulative impacts, a Revitalization Fund could be used to remedy disparities in housing, transportation, jobs, etc., in order to offset site-related health impacts.

An example of a similar fund is the Harbor Community Benefit Foundation (<http://hcbf.org>). The Foundation was established by a formal agreement between the Port of Los Angeles and community, environmental, health, and labor organizations. The Foundation is funded by the Port of Los Angeles to improve community health, access to open space, and economic opportunities, until cumulative impacts from Port activities are reduced.

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8. These recommendations are directed specifically to EPA.

Photos, left to right: Paul Joseph Brown; BJ Cummings, Duwamish River Cleanup Coalition/TAG; Linn Gould, Just Health Action





Photo: Paul Joseph Brown

## Effects of the proposed cleanup plan on subsistence fishing populations

Detailed information, including references, for this chapter is in the “Subsistence Fishing” Technical Report.

Subsistence fishing is defined for this HIA as non-sport fishing performed to provide food occasionally or frequently for the fishers and their friends and families.

### COMMUNITY PROFILE

Urban subsistence fishing is important nationally and locally for various reasons. There is little information with which to characterize the local fisher population. Surveys indicate that a large fraction of the local fisher population is comprised of Asian and Pacific Islander (API) immigrants and Americans, reflecting the large API community in King County. However, surveys also document fishing by other immigrant populations and people of color; low-income, food-insecure populations; and urban American Indians and Alaska Natives.

### CURRENT HEALTH STATUS

There are no data available to characterize the health status of subsistence fishers. However, it is known that immigrant, low-income, and food-insecure populations generally face a number of health challenges that affect disease burden. These often include language barriers, unemployment, and transportation barriers. For example, the foreign-born population in King County is three times as likely to speak a language other than English at home,

twice as likely not to have a high school diploma, more likely to have no health insurance coverage, and more likely to fall below the poverty level.

### FISHING PRACTICES

Focus groups and interviews with local non-tribal subsistence fishers suggest that many people fish for a variety of cultural and traditional reasons: for recreation and relaxation, as a convenient and inexpensive source of perceived healthy and culturally relevant food, and as an opportunity to spend time with friends and family. Many of these fishers catch and consume fish from numerous waterways in the region. Popular fishing locations identified through focus groups include Des Moines, Tukwila, Green Lake, Lake Washington, Elliott Bay, Alki Beach, and Snohomish County. People do fish on the Duwamish River, in spite of advisories and posted signs. Reasons for choosing fishing locations vary by population and include convenience, accessibility, cultural and traditional significance, water quality, visual cleanliness of the river and riverbank, and species of fish available to catch.

### INSTITUTIONAL CONTROLS

Seafood advisories and posted signs are currently in place along the Duwamish River. They will continue to be used as institutional controls during and after the cleanup to reduce exposure to contaminated seafood.



The EPA's 2013 *Environmental Justice [EJ] Analysis* of the proposed cleanup Plan discussed using a community-based social marketing approach such as one used for the Palos Verdes Shelf Superfund site. The *EJ Analysis* also described possible "offsets," such as fish trading and sustainable aquaculture projects, to mitigate potential health consequences of residual contamination and institutional controls.

## POTENTIAL HEALTH IMPACTS OF THE CLEANUP

Fishing practices and health could be impacted during or after active cleanup. Potential health impacts are likely to vary substantially by population. We considered potential impacts in three major areas: exposure to chemical contaminants, food and nutritional insecurity, and disruption of social and cultural traditions.

### **Exposure to chemical contaminants**

*Direction of effect:* ADVERSE

*Likelihood:* Very likely

*Magnitude:* Limited to moderate

*Distribution:* Disproportionate harm to lower-income and non-English speaking people, and people who fish for social, cultural, or traditional reasons

*Health outcomes:* The cancer and non-cancer risks of continued fishing are described in the Human Health Risk Assessment.

*Assessment:* Some communities, including API and low-income populations, have relatively high rates of fishing and fish consumption. During the cleanup, visible evidence of cleanup activity could decrease fishing on the Duwamish River and could reduce consumption of seafood caught from the river. However, it is likely that some people will continue to fish there, because of convenience, preferences, or limited transportation options. During and after the cleanup, some people who now fish on the Duwamish River may decide to fish in alternate locations, including other local urban waters. It is likely they would continue their level of fishing activity and caught-seafood consumption, unless constrained by added travel time or costs. These fishers, and the people with whom they share their catches, will probably experience reduced exposure to toxicants, compared to fishing on the Duwamish River. However, many alternate locations identified in our focus groups are subject to fishing and fish consumption advisories, particularly waters

within closer travel distances. Seafood caught and consumed from these alternate locations could still present substantial health risks.

Existing advisories and signs have not dissuaded fishing on the Duwamish River. The institutional controls for the proposed cleanup are not well described, which stands in stark contrast to the extent of assessment and planning conducted for cleanup activities. Institutional controls have limited likelihood of success, unless they better address the complex cultural context surrounding fishing and seafood consumption in this region. Some of the "offsets" described in the EPA *EJ Analysis* might appeal to some fishing populations; however, our limited focus group experience found mixed or negative responses to some of the options.

After active cleanup, people who currently do not fish in the Duwamish River might begin fishing there because of real and perceived improvement in river safety and visual appeal. Although seafood caught and consumed from the cleaner Duwamish River would pose less risk than at present, the persisting health risks could still be substantial.

These potential impacts will disproportionately affect fishers who: do not know about or understand fishing advisories; do not identify the risk of fishing and seafood consumption as substantial compared to the convenience, dietary, social, or cultural benefits of fishing on the Duwamish River; or have limited options to travel to other, safer waters. These impacts are likely to be disproportionate for lower-income people and people of color.

### **Food and nutritional insecurity**

*Direction of effect:* ADVERSE

*Likelihood:* Likely

*Magnitude:* Limited to moderate

*Distribution:* Disproportionate harm to low-income and food-insecure people

*Health outcomes:* A fish diet has distinct health benefits, including omega-3 fatty acids and other nutrients with protective value against high blood pressure, cardiovascular disease, and stroke. These nutrients also promote healthy brain development and growth in infants and children. Reduced fish consumption could adversely affect health by loss of these benefits. Furthermore, other protein sources are more costly than self-caught fish. People might experience food insecurity or fill a dietary void with less healthful choices.

*Assessment:* It is likely that some individuals will decrease or even discontinue fishing activities because of visible cleanup activities and expanded fishing advisories. Some people may choose to replace self-caught fish with store-bought fish, leading to increased economic hardship, especially among the region's low-income and food-insecure fishing populations. However, one undesirable consequence of "effective" advisories could be a net reduction in healthful fish consumption by fishers and their families. This reduction could be worsened by replacement with lower cost and readily available foods that are less likely to be healthful than fish.

***Disruption of social and cultural traditions***

*Direction of effect:* ADVERSE

*Likelihood:* Likely

*Magnitude:* Limited to moderate

*Distribution:* Disproportionate harm to people who fish for social, cultural, and traditional reasons

*Health outcomes:* Disruption of cultural or traditional practices could affect personal and social identity, and create stress or anxiety, with impacts on well-being and mental health. Decreased contact within fishing communities may

foster isolation and erosion of social capital. Low social capital is independently associated with poor health outcomes and, particularly if combined with low income or existing social marginalization, could contribute to an increased burden of poor health. Decreased fishing activity could be replaced with indoor or sedentary activities, with a net decrease in exercise and nature contact, both of which are associated with poorer health. Regular exercise, even at low to moderate levels of exertion, reduces the risk of obesity, hypertension, and cardiovascular disease.

*Assessment:* In published literature on urban fishers, and in our focus groups, commonly reported reasons for fishing include: traditional and cultural significance, particularly eating a self-caught rather than purchased fish; exercise; spending time with family and friends; and relaxation. It is possible that some people currently fishing on the Duwamish River will reduce or discontinue fishing and consuming self-caught fish, rather than traveling to alternate locations, with some loss of social ties. There is limited information to assess how likely this would be, but the health impact could be limited or moderate. The impact would disproportionately affect lower-income people with limited time or transportation.

Photo: BJ Cummings, Duwamish River Cleanup Coalition/TAG





Photo: Paul Joseph Brown

## RECOMMENDATIONS<sup>9</sup>

1. ***Institutional controls should go beyond restrictive and informational actions, such as advisories to avoid contaminated fish. Interventions should emphasize positive alternatives, such as identifying, encouraging, and providing options for safe fishing and healthful fish consumption.***

Advisories have repeatedly proven to have limited effect on the targeted fishing practice, locally on the Duwamish River and elsewhere. Efforts to dissuade fishing on the Duwamish River may have the best chance to be truly effective and least discriminatory if people are provided other, healthier options that will directly address and satisfy the reasons that they harvest or consume fish or shellfish.

2. ***There is a clear need for innovative thinking about how to discourage fishing (for resident fish and shellfish) on the Duwamish River and how to promote safe and healthful fishing alternatives. Possible options to explore in consultation with fishing communities include:***

*Explore some of the “offsets” identified in the EPA Environmental Justice Analysis for the Duwamish River cleanup.*

Our focus groups with local fishers suggest that acceptance and cultural appropriateness of offsets will vary between and within populations. Some of the listed options might appeal to some fishing populations, but we found mixed or negative responses to some of the options.

*Provide a sufficient and reliable supply of fish to food banks in the communities where current and prospective fishing populations are located.*

One survey of local food bank clients found 40% of client families fished for food, including 8% who fished in

the Duwamish River. Providing a reliable source of fish for these lowest income and food insecure populations through programs such as SeaShare may alleviate at least their dietary drivers for fishing, and may give them flexibility to be more selective in choosing locations when they fish for other reasons (e.g., cultural tradition, family recreation, etc.).

*Establish community supported fishery (CSF) programs—analogue to community supported agriculture (CSA) programs—in communities where fishing populations are located.*

As with CSA programs, CSFs allow members to purchase shares of fish and other seafood caught by local fishers. These shares provide members with a regular source of lower-cost fish and shellfish, and directly benefit local fishers with financial support.

*Build and maintain urban fishing ponds near the affected fishing communities.*

Reasons for fishing vary between populations. Many people fish for cultural and recreational reasons in addition to fishing for an inexpensive source of food. Other states have developed urban fishing ponds to provide safe, local fishing locations for urban or land-locked communities. Allowing people to keep and consume the fish they catch would encourage continued fish consumption while maintaining fishing activities. Catch-and-release ponds would also allow for continued opportunities for exercise, nature contact, and socializing. Urban fishing ponds were generally well-supported by focus group participants, who agreed that these locations should be aesthetic and relatively natural environments to maximize the appeal for fishers.

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9. These recommendations are directed specifically to EPA.



- 3. Efforts to promote safe or safer fishing practices should acknowledge that the target audience is more than just people who currently fish on the Duwamish River. The target audiences include people who might fish on the Duwamish in the future. Any intervention effort should include plans to periodically reassess if all appropriate populations are being served.**

A cleaner river after active cleanup may eventually attract people who do not currently fish on the river, either because of misperception that resident fish are then safe or because fishing there is a best or better option in a limited set of options. It is important to note that some minority or immigrant populations that are presently small in number in the Seattle area are projected to grow, and the composition of the urban fisher population may change over time.

- 4. All efforts to provide information, communicate advisories, and promote safe and healthful alternative options should be culturally appropriate and relevant for each target audience, and should be designed to help individuals make informed choices.**

Current and prospective future fishers on the Duwamish River are highly diverse in terms of race, ethnicity, nationality, and language. Their reasons for fishing and fish consumption are equally diverse. There are probably no interventions that will broadly address the perspectives and needs of all groups, without tailoring the intervention for individual groups. Methods to ensure that individuals have the information and awareness to make informed choices could include:

*Distribute maps to fishing communities that identify regional fishing locations, the associated advisories or concerns about contamination, and the types of fish available to catch that are safe for consumption.*

Fishers could more easily choose safer, less contaminated fishing locations if they have clear descriptive information on other local fishable waters. These maps and other materials would need to account for the different languages and levels of literacy and numeracy in the diverse fishing communities. This could be accomplished by involving members of affected commu-

nities in developing, reviewing, and distributing these materials.

*Incorporate community engagement efforts to develop outreach and educational strategies around fish advisory awareness.*

The methods used for the Palos Verdes Shelf Superfund cleanup site represent one good community-participation model to consider. We emphasize, however, that the most valuable lessons to learn from this model relate to community engagement and participation, and not the primary focus on fish advisories. This model could be useful for some populations but not others.

*Partner with fishing community members to develop specifically tailored risk communication interventions.*

The community-engagement model used in Georgia by Derrick and colleagues (2008) is a good example of an effective approach to developing a culturally tailored risk communication strategy to increase knowledge of contamination and fish advisories and improve ability to make informed choices.

- 5. All efforts to provide information, communicate advisories, and promote safe and healthful alternative options should engage and empower members of fishing populations so they can participate meaningfully in all stages of any prospective interventions, from initial conception and planning through implementation and follow-up monitoring for success.**

The methods used by Burger and colleagues (2013) in New Jersey provide an excellent model for effectively engaging community members as research partners in planning and implementing research, evaluating and interpreting findings, and developing and disseminating risk communication information. Community-based participatory methods can best ensure that interventions will account for the knowledge, beliefs, and cultural, social, and economic needs of fishers and their families. Although these methods are more time and resource intensive than traditional agency or “expert” driven approaches, they are more likely to ensure success.



Photo: Paul Joseph Brown

## Next steps

This is an *Advance HIA Report*, summarizing our findings and recommendations to date. The report identifies potential unanticipated or under-considered health effects of the proposed cleanup Plan. The report also identifies opportunities to minimize harmful impacts, increase beneficial effects, and help promote equity. A *Final HIA Report* will be released before the end of the public comment period for the proposed Plan. That report will expand upon findings in the present report, and will have additional information, which we describe in this chapter.

### WORKERS AND EMPLOYMENT IN LOCAL INDUSTRIES

Traditional manufacturing, water dependent, and freight handling establishments in the Duwamish Valley face a variety of pressures that threaten their productivity and economic viability, and that could stimulate changes in land use analogous to ongoing residential gentrification in local neighborhoods. The health impact of greatest concern is worker employment in local industries. Employment is one of the strongest favorable determinants of health and well-being. It is conceivable that the cleanup and related decisions could add to unfavorable pressures on local industries, with net loss of family wage jobs. This could disproportionately harm lower-income households. However, it is also conceivable that existing businesses and employment could benefit substantially if the cleanup reversed the constraints and stigma of a blighted river, and if this stimulated efforts to revitalize economic robustness.

### INFORMATION GAPS & UNCERTAINTIES

Identifying information gaps is an important goal for any HIA, almost as important as identifying health impacts. If the evidence base about possible health effects is incomplete, then decision-makers could make unfounded choices that adversely affect health or create inequities, and that might have been avoidable. Conversely, opportunities to benefit health or to restore equity could be lost if they are recognized too late.

Decision-makers need to know about information gaps, to consider whether they should gather more information, amend the decision process or timeline, or alter a decision they might otherwise make. It is also challenging for members of the public and other stakeholders to participate meaningfully during a limited time period for public comment, if they do not have a complete picture that allows truly informed consent or comment.

#### *Uncertainties in the proposed cleanup Plan*

The models of future river sediment and fish and shellfish tissue concentrations predict that the Plan's health-protective goals will not be fully achieved. Resident fish and shellfish will probably still be unsafe for human consumption, and higher than Puget Sound background levels, even after the 17-year period of active cleanup and monitored recovery. Therefore, the Plan is critically dependent on **institutional controls** to protect human health during and after cleanup of the river. However, there is a striking contrast between the extensive effort and information to characterize proposed cleanup efforts, and the limited

rigor in planning for or evaluating institutional controls, which are projected to last at least 40 years and could persist in perpetuity. In fact, the institutional control plan is better characterized as a plan to make a plan.

The health consequences of residual, site-specific chemical contamination in the river and of the institutional controls themselves are potentially substantial, and these could pose disproportionate harm for the affected Tribes and lower-income subsistence fishing households. It is not possible to adequately assess these potential health impacts, given the gaps in information.

Another important gap in the Plan is the lack of formal connection to a **source control** plan. The cleanup goals for contaminant reduction, and the certainty of achieving those goals, depend critically on the timing and extent of source controls. It is not possible to fully assess the potential health impacts of residual contamination in river sediments and resident fish and shellfish, without knowing the timing and extent of source controls. In our *Final Report*, we will assess possible benefits of including specific source control goals and measures in the cleanup Plan.

### **Information gaps for affected populations**

As we describe in this report, there is little available information about health of the specific affected Tribes, particularly from a holistic perspective that would capture Tribal views of health and well-being. Population monitoring in Washington State and King County, however, reveals that regional Tribes suffer profound disparities in biomedical measures of disease and risk factors. There is also little information about urban subsistence fishing populations.

These gaps in information make it impossible to fully assess the potential health impacts of the proposed cleanup, and particularly institutional controls. It is feasible to collect information that would fill these gaps, and doing so would provide a greater understanding of and ability to address health impacts to these populations.

## **CUMULATIVE IMPACTS**

It is essential that any potential health impacts of the proposed cleanup consider cumulative impacts and be judged in that context, as an increment to any existing disproportionate burden of disease and risks for poor health. This report describes cumulative health impacts on regional Tribes and, to the degree possible, the specific Tribes affected by Duwamish River contamination and the proposed cleanup. The report gives recommendations to help restore equity, including a “Revitalization Fund.” The *Final Report* will describe cumulative health impacts on local residents and will present options to promote equitable

community revitalization in the face of ongoing gentrification. As we describe in this *Advance Report*, gentrification could be aggravated by having a cleaner river.

## **BENEFITS AND OPPORTUNITIES**

Seattle and the Puget Sound region are at the cusp of a new era. Beginning with the cleanup, and accompanied by source control and natural restoration efforts, the Duwamish River and Valley have a chance to become a regional asset and symbol of pride, rather than an environmental stigma. There will be opportunities to turn river cleanup and restoration into a national model for healthful and sustainable coexistence of industry, Tribes, and community, serving economic, traditional, subsistence, and recreational uses. These opportunities could yield potential health benefits, but some revitalization pressures could aggravate existing disparities. The *Final Report* will describe our assessment of these opportunities and pressures, with recommendations to promote equitable revitalization that could benefit the populations of concern and the region as a whole.

## **EQUITY**

This Advance Report gives recommendations separately for three vulnerable populations: local residents, affected Tribes, and non-tribal, urban subsistence fishers. We stress that some of our recommendations are cross-cutting and apply to all of these populations. Most recommendations are directed towards the EPA, but some are indirectly or directly applicable to local decision makers.

Our *Final Report* will provide additional recommendations to local decision makers. It is noteworthy that the City of Seattle and King County are Potentially Responsible Parties for the cleanup, and as civic entities they are also responsible for protecting and improving the health and well-being of all people in their jurisdictions. At face value, cleaning up the Duwamish River will address both responsibilities. However, as we describe in this report, without targeted interventions, the proposed cleanup could result in unanticipated harms to vulnerable populations.

One of our key cross-cutting recommendations is to “ensure equity in all policies, programs, and tools regarding environment and community development, in accordance with Seattle’s Race and Social Justice Initiative and King County’s Equity and Social Justice Ordinance.” It is critical that there be meaningful and collaborative participation with the affected communities in all efforts to prevent harm from the cleanup and to promote health and equity.





Photo: BJ Cummings, Duwamish River Cleanup Coalition/TAG